June 10, 2003
Project No.: 843605.0101

Mr. Abdullah Akram
California Department of Transportation
111 Grand Avenue, 14th Floor
Oakland, California 94612

Re: Site Investigation Report, State Route 101, Sonoma County, California

Dear Mr. Akram:

Shaw Environmental, Inc. is pleased to submit this report for a site investigation conducted along State Route 101, Sonoma County, California. This report is submitted in accordance with Contract No. 43A0078, Task Order No. 04-281111-CS.

If you have any questions, please feel free to contact me at (916) 565-4183 at your convenience.

Sincerely,

SHAW ENVIRONMENTAL, INC.

Martha J. Adams, P.E.
Project Manager

Site Investigation Report
SON 101 - SB Auxiliary Lane

**PREPARED FOR:**

CALIFORNIA DEPARTMENT OF TRANSPORTATION
DISTRICT 4
OFFICE OF ENVIRONMENTAL ENGINEERING, HAZARDOUS WASTE BRANCH
111 W. GRAND AVE
OAKLAND, CALIFORNIA

**PREPARED BY:**

SHAW ENVIRONMENTAL, INC.
1326 NORTH MARKET BOULEVARD
SACRAMENTO, CALIFORNIA

**CONTRACT NO.: 43A0078**
**TASK ORDER NO.: 04-281111-CS**

# SITE INVESTIGATION REPORT
## AERIALLY DEPOSITED LEAD INVESTIGATION
## SON-101-SB AUXILIARY LANE
## PETALUMA, SONOMA COUNTY, CALIFORNIA

June 10, 2003

Prepared for:

California Department of Transportation
North Region Hazardous Waste Office
District 4
111 Grand Avenue, 14th Floor
Oakland, California  94623

Prepared by:

Shaw Environmental, Inc.
1326 North Market Boulevard
Sacramento, California  95834-1912

**Task Order No.:  04-281111-CS**
**Caltrans Contract No.:  43A0078**

**Project No.:  843605.0101**

**Shaw Environmental, Inc.**

Martha Adams, P.E.
Project Manager

## *Report Limitations*

This report has been prepared in accordance with generally accepted practices using standards of care and diligence normally practiced by recognized consulting firms performing services of a similar nature. This report presents our professional judgment based upon data and findings identified in this report and the interpretation of such data based on our experience and background, and no warranty, either expressed or implied, is made. The conclusions presented are based on the current regulatory climate and may require revision if future regulatory changes occur.

The findings identified in this report are predicated on the results of the limited sampling and laboratory testing performed. This report does not address impacts related to sources other than those specified herein.

The contents of this report reflect the views of Shaw Environmental, Inc., who is responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the State of California or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

**SHAW ENVIRONMENTAL, INC.**

Martha Adams, P.E.
Project Manager

**CALIFORNIA DEPARTMENT OF TRANSPORTATION**
**OFFICE OF ENVIRONMENTAL ENGINEERING - HAZARDOUS WASTE BRANCH**

Reviewed by:

Abdullah Akram, PE
Task Order Manager

Approved by:

Allen Baradar, PE, REA
Senior Environmental Engineer

## Project Team

| Contact | Affiliation | Responsibility |
| --- | --- | --- |
| Celia McCuaig, P.E.<br>(510) 286-5651 | Department – District 4<br>Office of Environmental Engineering,<br>Hazardous Waste Branch<br>111 Grand Avenue, 14th Floor<br>Oakland, California 94623 | Contract Manager |
| Abdullah Akram, P.E.<br>(510) 622-0159<br>Naveen Aachi<br>(510) 286-4914 | | Task Order Manager |
| Martha Adams<br>(916) 565-4183<br>(916) 565-4356 fax | Shaw Environmental, Inc.<br>1326 North Market Boulevard<br>Sacramento, California 95834<br>*(Department Contractor)* | Project Planning and Coordination of Fieldwork and Sample Collection,<br>Laboratory Assignments,<br>Site Investigation Report |
| Cary Bean<br>(510) 237-4575<br>(510) 237-4574 fax | Precision Sampling, Inc.<br>1400 S. 50th Street<br>Richmond, California 94804<br>*(Shaw Subcontractor)* | Drilling Services |
| Ray James<br>(916) 362-8947<br>(916) 362-0947 fax | Sparger Technology, Inc.<br>3050 Fite Circle, Suite 112<br>Sacramento, California 95827<br>*(Shaw Subcontractor)* | Sample Holding<br>Laboratory Preparation<br>Laboratory Analysis<br>Laboratory QA/QC |

## Table of Contents



## List of Tables



## List of Figures



## List of Appendices

# *Executive Summary*

This report presents the results of the soil investigation that was conducted by Shaw Environmental, Inc. along State Route (SR) 101 in Sonoma County, California (Figure 1). The investigation as described in this report was conducted along the southbound median shoulder area of SR 101 between the East Washington Street on-ramp and the SR 116 East off-ramp in the City of Petaluma, California (Figure 2).

This investigation was conducted at the request and authorization of Mr. Abdullah Akram of the California Department of Transportation (Caltrans) and in general accordance with Caltrans Contract 43A0078, Task Order Number 04-281111-CS.

The purpose of the investigation was to evaluate the presence and concentration of aerially deposited lead in soil prior to improvement activities proposed for SR 101. The objective was to screen soil that will be excavated from the site during the proposed construction activities.

The site investigation included the advancement of 16 shallow soil borings using direct-push sampling equipment along the southbound median of SR 101. Three soil samples per boring location were collected for analysis from depths of 0.0 to 0.15 meters (0.0 to 0.6 feet), 0.3 to 0.45 meters (1.0 to 1.5 feet), and 0.60 to 0.75 meters (2.0 to 2.5 feet) below ground surface, respectively. A total of 48 soil samples were collected and submitted under chain-of-custody procedures for analysis by a California-certified analytical laboratory.

Lead was reported in soil samples collected from the site. Total lead concentrations ranged from less than 1.0 to 1,880 milligrams per kilogram (mg/kg) in soil samples analyzed. The source for the lead is not known, however, it is thought to be related to accumulation of dust and debris containing lead from leaded gasoline emissions.

Lead concentrations were compared to Total Threshold Limit Concentration (TTLC) of 1,000 mg/kg, and Soluble Threshold Limit Concentration (STLC) of 5 milligrams per liter (mg/l) values to evaluate whether the soil would be considered a California hazardous waste, should it become a waste. Two soil samples analyzed during this investigation exceeded the TTLC value of 1,000 mg/kg for total lead. A total of 4 soil samples were reported to contain total lead in excess of 750 mg/kg, a level requiring waste disposal in a Class I facility.

Twelve soil samples were reported to contain soluble lead at concentrations in excess of the STLC of 5 mg/l by Waste Extraction Test (WET) analysis. Soil samples reported to contain soluble lead exceeding the STLC would be considered a California Hazardous waste, should the soil become a waste.

Statistical evaluation of the soil data resulted in an arithmetic mean (average) concentration of total lead of 185.62 milligrams per kilogram (mg/kg) with corresponding 90% Upper Confidence Level (UCL) value of 252.50 mg/kg. Sufficient data was available to calculate a correlation between the total lead data and soluble lead data by the Waste Extraction Test (WET) in samples. The expected soluble lead concentration by WET analysis at the total lead 90% UCL obtained from regression analysis was 12.484 milligrams per liter (mg/l). Based on the statistical analysis, it is possible that the waste soil could be considered a hazardous waste. However, if the construction work is staged in a manner that segregates the excavated soil, waste soil from some areas may be considered hazardous and might be able to be managed under the California Environmental Protection Agency, Department of Toxic Substances Control, variance for waste soil considered hazardous due to the presence of elevated lead concentrations.

A summary of the statistical data is outlined below:

| Area | Soil Interval (m) | Total Lead Mean (mg/kg) | Total Lead 90% UCL (mg/kg) | Predicted WET Lead Concentration (mg/l) | Predicted DI WET Lead Concentration 90% UCL (mg/l) |
|---|---|---|---|---|---|
| SR 101 | 0.0 to 0.75 | 185.62 | 252.50 | 12.48 | 2.46 |

If management of the soil within the variance is required based on soluble lead concentrations, the statistical data indicate that the soil would be allowed to be reused within condition 2 of the variance, if the soil (0 to 0.6 meters) is excavated and treated as a whole. This condition requires that the soil be used as fill beneath a pavement structure designated to protect the soil from water infiltration and a minimum five feet above the maximum water table elevation. This conclusion is based on the total lead concentration reported from the project area and the predicted value of 2.46 mg/l for DI WET data within the 0 to 0.6 meter (0 to 2 feet) data set at the project site where construction is proposed.

# 1.0 Introduction

This report has been prepared by Shaw Environmental Inc. (Shaw) to present the results of the soil investigation that was conducted along State Route (SR) 101 in Sonoma County, California (Figure 1). The investigation as described in this report was conducted along the southbound median shoulder area of SR 101 between the East Washington Street on-ramp and the SR 116 East off-ramp in the City of Petaluma, California (Figure 2).

This investigation was conducted at the request and authorization of Mr. Abdullah Akram of the California Department of Transportation (Caltrans) and in general accordance with Caltrans Contract 43A0078, Task Order Number 04-281111-CS.

## 1.1 Project Description

Caltrans proposes to construct an auxiliary lane on southbound SR 101 between the East Washington Street on-ramp and SR 116 East off-ramp in the City of Petaluma, California. All work for this site investigation was performed within Caltrans right-of-way along the unpaved shoulder area of the southbound median.

Shaw is not aware of any previous site investigative work in the project area.

## 1.2 Project Objective

The objective of this investigation was to determine the presence or absence of hazardous concentrations of aerially deposited lead (ADL) in shallow soil within the existing right-of-way of SR 101 in Sonoma County. The purpose of this site investigation was to screen soil for ADL that will be excavated from the site during the proposed construction activities.

The results from the ADL investigation will be used to assess worker health and safety issues, soil handling and disposal procedures, and determine the applicability of the Department of Toxics Substance Control (DTSC) variance for re-use of lead contaminated soil.

# 2.0 Scope of Work

The scope of work for the investigation was presented in Shaw's workplan dated April 8, 2003, which was approved for implementation by Caltrans. The following scope of work was conducted:

1. Planning and Permitting
2. Field Investigation
3. Laboratory Analyses
4. Site Investigation Report Preparation

## 2.1 Planning and Permitting

Planning and permitting included a pre-work site visit, and preparation of a work plan and health and safety plan.

Mr. Ed Simonis and Mr. Ian Moorhead of Shaw and Mr. Abdullah Akram and Mr. Naveen Aachi of Caltrans conducted a pre-work site meeting on March 24, 2003. Items discussed and reviewed during the meeting included the scope of work, the site visit checklist, and the project schedule. Mr. Ed Simonis and Mr. Ian Moorhead of Shaw performed a field reconnaissance of the project area and marked the boring locations for Underground Service Alert (USA).

A site-specific workplan (Shaw, 2003a) was prepared presenting the scope of work and the procedures used during the investigation. The workplan also provided information regarding laboratory analyses, investigation-derived waste, and report preparation.

A site-specific health and safety plan (Shaw 2003b) was prepared in general accordance with 29 Code of Federal Regulations 1910.120. The health and safety plan included safety procedures for work to be performed at the site, chemical hazard information, site safety officers, and preferred medical emergency locations (Shaw, 2003b).

A boring permit from the County of Sonoma Environmental Health Services Department was not required for this project. USA was notified of the subsurface investigation at least 48 hours prior to initiation of the investigation.

All work was conducted within Caltrans right-of-way. Work was conducted between the hours of 9:00 A.M. and 3:00 P.M., in the unpaved portion of the southbound median shoulder area, where the shoulder was wide enough to allow for safe stopping of the sampling vehicle. Caltrans provided shoulder closure traffic control during the field activities.

# 3.0 Field Investigation

The field investigation was conducted on May 1, 2003. The site investigation included the advancement of 16 shallow soil borings using direct-push sampling equipment along the southbound median of SR 101 (Figure 2). The soil boring locations were selected according to Caltrans' Task Order No. 04-281111-CS.

The SR 101 ADL investigation included the advancement of 16 soil borings to provide data for the systematic evaluation of subsurface soil conditions prior to the implementation of the proposed construction activities. The soil borings were spaced approximately every 100 meters (330 feet), where the median was wide enough to allow for safe stopping of sampling vehicles. Where possible, the borings were located approximately 1.0 meter (3 feet) from the edge of the pavement.

Sixteen soil borings were advanced using direct-push drill methods (Geoprobe? ). The direct-push soil borings were advanced to a maximum depth of approximately 0.75 meters (2.5 feet) below ground surface (BGS). Three soil samples per shallow direct push boring were collected and retained for chemical analysis. The soil samples were collected from the following intervals.

?? Surface to 0.15 meters (0.5 feet) BGS

?? 0.3 to 0.45 meters (1.0 to 1.5 feet) BGS

?? 0.60 to 0.75 meters (2.0 to 2.5 feet) BGS

Soil samples were labeled with the boring number, and the sample collection depth. For example, "SR101-1-0.6" represents the first boring collected at a depth of 0.6 to 0.75 meters (2.0 to 2.5 feet) BGS. A total of 48 soil samples were collected during this investigation. The direct push samples were collected directly from a 2.5-centimeter (1-inch) diameter direct-push rod containing an acetate sleeve. The sleeve was cut into discreet sample intervals as described above, and immediately capped and labeled. Following sample collection, the borings were backfilled with the remaining borehole cuttings.

The ADL soil samples were labeled, packaged and stored on ice in an insulated chest for transport under chain-of-custody manifest to a California-certified analytical laboratory. The ADL samples were delivered to the laboratory within 24 hours of sample collection. Drilling and sampling procedures are presented in Appendix A.

All drilling and sampling equipment was washed prior to use. In addition, to minimize cross-contamination between borings, all appropriate downhole drilling and sampling equipment was washed between borings. Wash water generated during the field investigation was poured onto the ground, avoiding any run-off to storm drains or conduits to surface water bodies, and was allowed to soak into the soil. Solutions were poured onto the ground in such a way as to avoid runoff.

The horizontal and vertical locations of the borings were established using a Trimble GPS Pathfinder? Pro XRS global positioning system (GPS). The GPS utilized a GPS receiver and MSK radio beacon differential receiver. The GPS is reported to have sub-meter accuracy for horizontal location of the borings. The vertical accuracy is reported to be two to five times that of the horizontal precision. The GPS data was downloaded in the office and Trimble software was utilized to provide differential corrections to the coordinates. The horizontal and vertical datums used for this investigation were the California Coordinate System of 1983 (CCS83), Zone 2, and the North American Vertical Datum of 1988 (NAVD88), respectively. The standard unit of measurement for both of these datums was the meter.

## *3.1 Laboratory Analyses*

The soil samples collected and retained for analysis were submitted to Sparger Technology, Inc. (Sparger), of Sacramento, California, a California-certified analytical laboratory (ELAP #1614). Chain-of-custody procedures, including the use of chain-of-custody forms, were used to document sample handling and transport from the time of collection to delivery to the laboratory for analysis. The chain of custody forms and laboratory analytical reports are included in Appendix B.

A total of 48 soil samples were submitted for laboratory analysis. The analyses were conducted on a 48-hour turn-around basis in general accordance with Environmental Protection Agency (EPA) specified holding times. The analyses were performed on selected samples in general accordance with the following methods.

| Matrix | Analyses |
|---|---|
| Soil | ICAP EPA 6010: lead only (all soil samples) |
| Soil | Waste Extraction Test (WET) 22CCR 667000 Ext raction and 6010 Analysis |
| Soil | pH EPA 9045 |

A total of 48 soil samples were analyzed for total lead in general accordance with EPA Method 6010. Soil samples reported to contain total lead concentrations in excess of 50 milligrams per kilogram (mg/kg) and less than 1,000 mg/kg were further analyzed for soluble lead using the WET. The total lead concentration of 50 milligrams per kilogram (mg/kg) was selected because it is 10 times the Soluble Threshold Limit Concentration (STLC) of 5.0 milligrams per liter (mg/l). A total of 14 soil samples were analyzed for soluble lead by the WET method.

Samples with soluble lead concentrations greater than or equal to 5.0 mg/l were further analyzed for soluble lead by the WET using a deionized water extraction solution (DI WET). A total of 12 soil samples were analyzed by the DI WET method. Soil samples exceeding the Total Threshold Limit Concentration (TTLC) of 1,000 mg/kg were further analyzed using the Toxicity Characteristic Leaching Procedure (TCLP). A total of six soil samples were analyzed by the TCLP method.

A total of six soil samples, chosen at random, were tested for pH.

# 4.0 Site Investigation Results

## 4.1 Lead Investigation Results

Lead analyses were conducted on 48 soil samples from the SR 101 project limits. A summary of lead results compared to 10 times STLC and TTLC values are presented below. Results are presented on Table 1, and certified analytical reports and chain-of-custody forms are included in Appendix B.

| Heavy Metal | Total Lead Concentration Range (mg/kg) | 10 Times STLC (mg/kg) | No. Samples Exceeding 10 Times STLC | TTLC (mg/kg) | No. Samples Exceeding TTLC |
|---|---|---|---|---|---|
| Lead | < 1 to 1,880 | 50 | 16 | 1,000 | 2 |

Fourteen soil samples were further analyzed for soluble lead concentrations by the WET method. Six soil samples were further analyzed for soluble lead concentrations by the TCLP method. A summary of soluble heavy metal results is presented below.

| Heavy Metal | STLC (mg/l) | No. Samples Exceeding STLC | WET Concentration Range (mg/l) | DI WET Concentration Range (mg/l) | TCLP Concentration Range (mg/l) |
|---|---|---|---|---|---|
| Lead | 5.0 | 12 | 3.96 to 49.1 | 0.736 to 9.79 | <0.05 to 2.11 |

In six soil samples tested, pH ranged from 7.8 to 9.1 (Table 1).

# 5.0 Data Evaluation

## 5.1 Lead Concentrations and Distribution

Soil samples collected from the site were reported to contain lead (Table 1). The source for the lead is not known. However, studies along the transportation corridors have attributed elevated lead concentrations within soil to accumulation of dust and debris-containing lead from leaded gasoline emissions (Coltrin, et al., 1993).

The majority of the soil samples containing elevated lead concentrations were collected from the surface to 0.15-meter depth interval. A summary of the distribution of the elevated lead concentrations is presented below. The data set is restricted to those samples reported to contain greater than or equal to 50 mg/kg lead, a level selected because it is 10 times the STLC.

| | | Distribution of Samples from Total Sample Population with Greater Than 50 mg/kg Lead | | Distribution of Samples from Interval with Greater Than 50 mg/kg Lead | | Distribution of Samples from All Samples with Greater Than 50 mg/kg Lead | |
|---|---|---|---|---|---|---|---|
| **Sample Area** | **Sample Interval** | **Number** | **Percentage** | **Number** | **Percentage** | **Number** | **Percentage** |
| SR 101 | 0.0 to 0.15 m | 15 of 48 | 31.25 | 15 of 16 | 93.75 | 15 of 16 | 93.75 |
| SR 101 | 0.3 to 0.45 m | 1 of 48 | 2.1 | 1 of 16 | 6.25 | 1 of 16 | 6.25 |
| SR 101 | 0.6 to 0.75 m | 0 of 48 | 0.0 | 0 of 16 | 0.0 | 0 of 16 | 0.0 |

As shown above, the number of samples containing elevated lead concentrations decreased with depth. This is typical of accumulations of ADL as reported by Coltrin and others (1993), where lead concentrations were observed to decrease with depth.

Lead concentrations were compared to TTLC (1,000 mg/kg) and STLC (5.0 mg/l) values to evaluate whether the soil would be considered a California hazardous waste, should it become a waste. Generally, TTLC and STLC values for lead are used to judge whether a waste is a California hazardous waste based on the total or soluble concentration of lead within the waste. The TCLP values are used to judge whether a waste is a Resource Conservation and Recovery Act (RCRA)-hazardous waste (also known as a Federal hazardous waste) based on the soluble concentration of lead within the waste.

Twelve soil samples collected had soluble lead at concentrations in excess of the STLC of 5.0 mg/l by WET analysis. Soil samples reported to contain soluble lead exceeding the STLC would be considered a California Hazardous waste, should the soil become a waste.

Two soil samples (SR101-4-0.00 and SR101-6-0.00) were reported to contain total lead at a concentration in excess of the TTLC of 1,000 mg/kg. Soil samples reported to contain total lead exceeding the TTLC would be considered a California Hazardous waste, should the soil become a waste.

Soil samples at 4 boring locations exceeded 750 mg/kg and would require disposal at a Class I landfill should the soil at these locations become a waste.

The California Environmental Protection Agency, DTSC, granted Caltrans a variance for soil considered hazardous due to the presence of elevated lead concentrations (DTSC, 2000). The variance allows Caltrans to reuse lead-contaminated soil within Caltrans right-of-way in the roadway corridor boundaries under certain conditions if the soil is considered a non-RCRA waste. Assembly Bill 414 allows Caltrans to reuse soil with total lead concentrations of up to 1,496 mg/kg. However, within the jurisdiction of the Regional Water Quality Control Board, San Francisco Bay Region, Caltrans is restricted to total lead concentrations of less than 750 mg/kg, in accordance with HSC 25157.8. Therefore, in accordance with the variance and HSC 25157.8, the following conditions apply to Caltrans' re-use and management of soil impacted by ADL as fill material for construction and maintenance operations (DTSC, 2000):

1. As fill beneath at least one foot of clean (non-hazardous) soil and a minimum five feet above the maximum water table elevation if the soluble lead concentration reported by the DI WET analysis is less than 0.5 mg/l and the total lead concentration is less than 750 mg/kg. This condition applies only if the soil is not a RCRA waste.

2. As fill beneath a pavement structure designated to protect the soil from water infiltration and five feet above the water table if the soluble lead concentration reported by DI WET analysis is greater than 0.5 mg/l but less than 50 mg/l, and the total lead concentration is less than 750 mg/kg. This condition applies only if the soil is not a RCRA waste.

3. Lead-contaminated soil with a pH below 5 shall only be used as fill beneath the paved portion of the roadway. This condition applies only if the soil is not a RCRA waste.

## 5.2 Lead Data Statistical Analysis

To further evaluate the applicability of the DTSC variance (DTSC, 2000), Shaw conducted a statistical evaluation of lead analytical data for this project at the request of Caltrans. The statistical evaluation was conducted in general accordance with the procedures discussed in EPA Technology Support Center Issue (EPA, December 1997). A statistical evaluation was conducted to further evaluate the concentration of lead within soil at the site. The statistical evaluation addressed the following items:

?? Calculation of mean;

?? Determination of the distribution of the sample data; and

?? Calculation of the 80% Confidence Intervals (CI) which provides the corresponding 90% Upper Confidence Level (UCL), interpreted as a 0.90 probability that the true mean for a given sample is no higher than the calculated UCL.

The data from all sample intervals were combined into one data set for analysis as Caltrans construction plans typically call for excavation of soil to 0.6 meter (2 feet) for road base preparation. A value of one-half the detection limit was used for non-detect values. Evaluation of the soil data for the entire sample population resulted in an arithmetic mean (average) concentration of total lead of 185.62 mg/kg (Appendix C).

A histogram of the total lead results for the entire data set was constructed to evaluate the distribution of the total lead concentrations within the data set. The data was found to be heavily skewed to lower concentrations (Appendix C). Therefore, statistical analysis was conducted using non-parametric techniques, which do not require that the data be drawn from a specific distribution (Gilbert, 1987).

The statistical analysis for the total lead data was conducted using the Bootstrap method (Efron, 1982) to estimate the 90% UCL for the mean of the total lead data. Bootstrap methods are non-parametric techniques to infer the distribution of a statistic derived from a data set. Bootstrap methods construct a "distribution" for a statistic (in this case the mean) by re-sampling with replacement from the data set. A large number ($B$) of data subsets of size $n$ (where $n$ is the size of the data subset) are selected. The statistic is computed for each of the $B$ data subsets of size $n$. This gives a sample of values of the statistic, rather than one value. Confidence limits for the population parameter that is estimated by the Bootstrapped statistic are then constructed using percentiles of the sampled distribution of the statistic.

The nonparametric bootstrap was used to compute the 90% UCL for the mean. There are several variations on the nonparametric Bootstrap. Efron's empirical quantile method (Efron, 1982) applied to the mean was used to estimate the 90% UCL for the mean for this data set. The 90% UCL calculated for total lead data was 252.50 mg/kg.

Pearson (product moment) correlation coefficients (Pearson values) were obtained from regression analysis for regression lines fit to the data (Appendix C). Prior to calculation of the correlation coefficients, the total/soluble lead bivariate data were visually inspected for outliers. A scatter plot was generated for the total/soluble lead data set. As discussed in Gilbert (1987), data points outside the main "data cloud" were considered outliers as they may not be from the same bivariate distribution as the remaining data points.

The correlation coefficient for the total/WET lead data was 0.98, which is above the minimum acceptable correlation coefficient value of 0.8, per Caltrans contract 43A0078. The correlation coefficient for the WET data indicate that acceptable correlation between total and WET soluble data does exist.

An expected soluble (WET) lead concentration was obtained from regression analysis (model fit to the data) developed from the total and soluble lead data. The coefficient for the dependant variables (slope of regression line) used in the regression analysis and the total lead versus soluble lead concentration plots are presented in Appendix C. The predicted soluble lead concentration for WET data corresponding to the total lead 90% UCL is 12.48 mg/l. A summary of the statistical data is outlined below.

An expected soluble (DI WET) lead concentration was obtained from regression analysis developed from the total and DI WET soluble lead data. The predicted soluble lead concentration for DI WET data corresponding to the total lead 90% UCL calculated using the bootstrap method was 2.46 mg/l.

| Area | Soil Interval (m) | Total Lead Mean (mg/kg) | Total Lead 90% UCL (mg/kg) | Predicted WET Lead Concentration (mg/l) | Predicted DI WET Lead Concentration 90% UCL (mg/l) |
|---|---|---|---|---|---|
| SR 101 | 0.0 to 0.75 | 185.62 | 252.50 | 12.48 | 2.46 |

### *5.2.1 Summary*

Soil at specific boring locations may be considered a California hazardous waste based on the total and soluble (WET) concentrations of lead reported in individual soil samples from the project limits.

Shaw conducted statistical analyses on the total and soluble lead data. The statistical analysis assumes that the soil will be handled as one waste stream. However, if the construction work is staged in a manner that segregates the excavated soil, waste soil from some areas may be considered hazardous and might be able to be managed under the DTSC variance.

The mean and 90% UCL were below the TTLC of 1,000 mg/kg. However, the expected soluble (WET) lead concentration was calculated by regression analysis and found to be greater than the STLC for lead. It is therefore possible that the waste soil could be considered a hazardous waste based on the statistical analysis conducted.

The mean concentration and 90% UCL values for total lead data were less than 750 mg/kg. This indicates that it is unlikely that the waste soil would require Class I disposal. Therefore based on statistical analysis the soil can be managed within the variance.

If management of the soil within the variance is required based on soluble lead concentrations, the statistical data indicate that the soil would be allowed to be reused within condition 2 of the variance, if the soil (0 to 0.6 meters) is excavated and treated as a whole. This condition requires that the soil be used as fill beneath a pavement structure designated to protect the soil from water infiltration and a minimum five feet above the maximum water table elevation. This conclusion is based on the total lead concentration reported from the project area and the predicted value of 2.46 mg/l for DIWET data within the 0 to 0.6 meter (0 to 2 feet) data set at the project site where construction is proposed.

## *6.0 Conclusions and Recommendations*

Based on the laboratory results, current regulatory guidelines and the judgment of Shaw, the following conclusions and recommendations are offered:

- ?? Lead was reported in soil samples collected within the project limits. The source for the lead is not known. However, studies along the transportation corridors have attributed elevated lead concentrations within soil to accumulation of dust and debris-containing lead from leaded gasoline emissions (Coltrin, et al., 1993).
- ?? Lead concentrations were compared to the TTLC and STLC values to evaluate whether the soil would be considered a hazardous waste should it become a waste. Two soil samples were reported to contain total lead concentrations that exceed the TTLC value of 1,000 mg/kg for lead. All TCLP results were below 5.0 mg/l, a level requiring disposal at a RCRA hazardous waste site. Twelve soil samples contained soluble lead at concentrations in excess of the STLC of 5.0 mg/l by WET analysis.
- ?? Soil samples at 4 boring locations were reported to contain total lead concentrations in excess of 750 mg/kg, a level requiring waste disposal in a Class I facility.
- ?? The statistical evaluation resulted in the following data:

| Area | Soil Interval (meters) | Total Lead Mean (mg/kg) | Total Lead 90% UCL (mg/kg) | Predicted WET Lead Concentration 90% UCL (mg/l) | Predicted DI WET Lead Concentration 90% UCL (mg/l) |
|---|---|---|---|---|---|
| SR 101 | 0.0 to 0.75 | 185.62 | 252.50 | 12.48 | 2.46 |

- ?? Based on the statistical analysis, it is possible that the waste soil would be considered a hazardous waste. However, if the construction work is staged in a manner that segregates the excavated soil, waste soil from some areas may be considered hazardous and might be able to be managed under the DTSC variance.

- ?? If management of the soil within the variance is required based on soluble lead concentrations, the statistical data indicate that the soil would be allowed to be reused within condition 2 of the variance, if the soil (0 to 0.6 meters) is excavated and treated as a whole. This condition requires that the soil be used as fill beneath a pavement structure designated to protect the soil from water infiltration and a minimum five feet above the maximum water table elevation. This conclusion is based on the total lead concentration reported from the project area and the predicted value of 2.46 mg/l for DI WET data within the 0 to 0.6 meter (0 to 2 feet) data set at the project site where construction is proposed.

## 7.0 References

Caltrans (California Department of Transportation, District 6), 2002, Caltrans Contract Number 43A0078, Task Order Number 04-281111-CS, SON-101-SB Auxiliary Lane, Petaluma, Sonoma County, California: dated February 6, 2003.

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**Table 1**
**Lead Analytical Data and GPS Locations**

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**Figure 1**
**Site Location Map**

**Figure 2**
**Boring Location Map**

# APPENDIX A
# DRILLING AND SAMPLING PROCEDURES

# APPENDIX B
# LABORATORY ANALYTICAL REPORTS AND CHAIN-OF-CUSTODY FORMS

# APPENDIX C
# LEAD STATISTICAL ANALYSIS SPREADSHEETS

# Appendix A
# Drilling and Sampling Procedures

The procedures that were used for drilling the borings, collecting soil samples, and collecting groundwater grab samples are presented below.

## Drilling and Soil Sample Collection

- Work was conducted in the unpaved portion of the southbound median of SR 101 at approximately 100-meter (328 feet) intervals, where the median was wide enough to allow for safe stopping of sampling vehicles.
- Where possible, the borings were located approximately 1.0 meter (3 feet) from the edge of the pavement
- Sixteen soil borings were advanced using Geoprobe™, direct-push, sampling equipment to a maximum depth of approximately 0.75 meters (2.5 feet) BGS for ADL sample collection.
- Each direct push boring was sampled at 0.0 meters (surface), at 0.30 meters (1.0 feet), and at 0.6 meters (2.0 feet) BGS.
- The direct push samples were collected directly from a 2.5-centimeter (1-inch) diameter direct-push rod containing an acetate sleeve. The sleeve was cut into discreet sample intervals and immediately capped and labeled.
- Soil cuttings that were not retained for laboratory analysis was used as backfill.
- The sampling equipment was washed in a detergent rinse, two clear water rinses, and a final deionized/distilled water rinse prior to drilling. Wash water generated during the field investigation was poured onto the ground, avoiding storm drains or conduits to surface water bodies, was allowed to soak into the soil. Solutions were poured onto the ground in such a way as to avoid runoff.

## Sample Retention and Analysis

- Chain-of-custody procedures, including the use of chain of custody forms, were used to document sample handling and transport from collection to delivery to the laboratory for analysis.
- The samples were retained in insulated chests preserved with ice and delivered to the laboratory within 24 hours of sampling. The samples were shipped via overnight courier to the laboratory.

?? Soil samples were labeled with the route number, boring number, and approximate sample collection depth. For example, SR101-1-0.30, where SR101 is State Route 101, 1 is the boring number, and 0.30 is the sample collection depth at approximately 0.30 meters BGS.

?? Laboratory quality assurance/quality control procedures are summarized below:

- Method Blank Frequency = one per 10 samples
- Matrix Spike/Matrix Spike Duplicate = one per 10 samples
- Laboratory Control Sample/Laboratory Control Sample Duplicate = one per 10 samples